



Naval Safety Center

LESSONS LEARNED



LL 20-24

COLD WATER DIVE MISHAP

Summary of Events

In the late afternoon hours of a summer day, three Coast Guard divers from a ship attempted to conduct cold water familiarization dives at a planned depth of 20 feet of seawater (fsw) during an ice liberty stop on the Arctic ice. After one of the divers exited the water due to an equipment malfunction, the two remaining divers continued the dive in 29 degree Fahrenheit waters. The divers quickly descended to approximately 200 fsw. Once topside personnel became aware that too much tending line had been paid out to support the planned dive, the divers were recovered to the surface and were later pronounced dead. The following provides condensed details and lessons from this tragic event.



Personnel

The Diving Officer (DO) was the most experienced diver assigned to the vessel and was the only qualified diving supervisor. His total diving experience was two years and three months, with 24 dives performed since completing dive school, of which zero were conducted in cold water SCUBA. Diver #1 had been a qualified diver for five months and had two career dives since completing dive school, of which zero were performed in cold water SCUBA. Diver #2 had been a qualified diver for just over a year and had completed four career dives since completing dive school of which zero were performed in cold water SCUBA. Diver #2 had not conducted a dive in the 10 months preceding the mishap. The Commanding Officer, Executive Officer, and Operations Officer were not qualified divers and had not received diving operations training.

Environment

The ship stopped on the ice for liberty, including several recreational type events and alcohol consumption. The air temperature was 28 degrees Fahrenheit and the water temperature was 29 degrees Fahrenheit. Winds were 8 knots. Ice covering was nine-tenths (very close pack) with a thickness of three to five feet of multi-year pack. The below-ice water depth was estimated at 1,420 meters (4,649 feet).

Dive Planning

On the morning of the planned ice liberty, the Diving Officer recognized the opportunity to perform a dive. The ship's divers were very inexperienced and the belief was this was an excellent opportunity to create proficiency and maintain qualification for the dive team. The submitted plan identified three divers performing cold water dives in single SCUBA with full face masks (known as "AGA"). All divers would wear dry suits and buoyancy compensators. The DO would be the Diving Supervisor and would perform this task while actively participating in the dive as a working diver. Diver #1 and #2 would dive with the DO. No standby diver was assigned. The dive tenders would be ship's force personnel that were not military dive qualified. The CO, OPSO, Diver #2, and one dive tender posed questions to the DO regarding the plan's validity. The DO assured each of them the dive was permitted by diving policy. The chain of command determined the dive to be a routine operation with minimal risk and approved. The entire approval process took approximately 30 minutes.

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Dive Station and Dive Brief

The dive station was set up on the open ice with no shelter. Diver #1 arrived with equipment 40 minutes before the other two divers. With no protection, diving equipment was staged directly on the ice. Once the remaining divers and dive tenders were on station and ready, the DO performed an informal dive brief that included basic instructions to the dive tenders of the meaning of the line-pull signals used during SCUBA diving. No formal checklists were used and no ORM brief was conducted. Once the dive brief and tender familiarization training were completed, the tenders assisted the divers with donning the equipment. All divers were equipped with a single steel 100 cubic-foot tank, full-face AGA mask with an additional regulator, a drysuit, and a buoyancy compensator (BC) with 40 pounds of weight distributed between the jettison pockets and zippered utility pockets. The dry suit inflation hose was connected to the first stage regulator, but the buoyancy compensator inflators were not.



The Dive

All three divers entered the water and conducted in water checks. Almost immediately, diver #2 had water intrusion into his drysuit, the suit inflation would not operate, and he could not maintain proper buoyancy. He discussed these issues with the DO and they decided that diver #2 would return to the dive locker to search for a new drysuit. Diver #2 exited the water and departed the dive station. The remaining two divers determined they were too buoyant and added approximately 10 additional pounds of weight in their BC for a total of

around 50 pounds each. Once they made the final adjustments, the divers descended below the surface. Approximately five minutes into the dive, diver #1 experienced water intrusion into his gloves and had to exit the water to rewarm his hands. The DO remained in the water but was on the surface. After a 10 minute rewarming period, Diver #1 replaced his gloves and re-entered the water. It was noted that his hands were still cold and lacked the dexterity to make the standard "OK" hand signal, so it was agreed that the "thumbs-up" signal would be used instead. Both divers again descended below the surface. The tenders paid out some line and the divers descended a few feet. Both were visible to the tenders when the DO sent one line-pull signal. The tenders understood this to mean the divers were ok, so they allowed more slack in the line. Tender #1 observed both divers' lines paying out fairly quickly. Upon seeing that the DO's line was close to being fully paid out, tender #1 stepped on the line to stop it. Tender #1 then felt a single tug on the line and thus continued to pay out additional line. Tender #2 initially observed the divers down to about 15 feet but then lost sight. They appeared to go under the ice. Early in the dive, tender #2 felt a moderate strain on his line. He then became distracted by ship's personnel engaged in ice-liberty events that had encroached on the dive station and inadvertently stepped on a tending line. Approximately three minutes after the divers submerged, Tender #2 stated that the line sped out in a fast and forceful way that required him to ask for help from a bystander. The line payed out for about 15 seconds, slowed slightly for a few seconds, then again increased in speed. Believing that about 100 feet of the line had payed out, tender #2 and his assistant stopped the line and gave pulls on the line to which no return pull was received. Both dive tenders had permitted the line to pay out until there was not much left on the spool, and they were concerned they might lose the line because it was not anchored to the ice. The total bottom time at this point was approximately 10 minutes.

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Diver #2 returned to the dive station and quickly determined that something was wrong. Four pulls were sent to both divers, and no response was received. At this point, diver #2 directed that both divers be recovered immediately. The total bottom time at this point was approximately 20 minutes.

The tenders began retrieval of divers at an initial rate of one foot per minute. At about 40 feet, both divers could be seen and appeared to be unconscious. Both divers were then rapidly recovered to the surface, pulled from the water, and resuscitation efforts started. Both divers

had been submerged for approximately 23 minutes. The DO's depth gauge showed a max depth of 185 feet and diver #1's depth gauge was maxed out, showing 200 feet. Both divers were unresponsive and lacked vital signs. Neither diver had jettisoned any weight. The crew on the surface attempted resuscitation, but they were not successful. Approximately one hour and 13 minutes after reaching the surface, both divers were pronounced dead.



Key Takeaways / Lessons Learned

The investigation following this event identified over 70 Human Factors (HFACS) that either directly caused or contributed to this event. An HFAC is considered “causal” when removal of that HFAC from the sequence of events would likely have broken the chain of errors and the mishap would not have occurred. An HFAC is considered “contributory” when it is not singularly responsible for the mishap; however, when combined with causal or other contributory errors, it influenced the mishap’s progression. Approximately 26 factors were determined causal and 45 were contributory. Think about this. There were at least 26 opportunities to avoid this mishap; 26 chances to prevent the death of two military divers. The following is a condensed summary of the findings:

1. Command oversight. The chain of command did not properly assess the hazards associated with the dive, identify the procedural inadequacy of the plan and did not prevent the operation from occurring when they had doubts about procedural compliance.
2. Planning. The plan presented by the Diving Officer lacked technical competence and failed to comply with established procedures in all regards.
3. Training. The entire chain of command, every diver, and every dive tender involved lacked the training necessary to perform this dive safely.
4. Equipment. The divers were not outfitted with equipment suitable for this dive, were overweighted, and their BC inflators were not connected.

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Key Takeaways / Lessons Learned (Continued)

Unanswered Questions

Many military divers will have questions regarding the divers' emergency actions during this event. Why didn't they climb the tending line? Why didn't they inflate their dry suits? Why didn't they send other line-pull signals? Why didn't they ditch their weight? Although these questions can never be fully answered, physical task oversaturation could have been a factor. At a minimum, the divers would have had to: 1. Recognize what was happening; 2. Clear their ears; 3. Inflate their drysuits, 4. Drop their weights; 5. Signal each other; and 6. Signal the tenders. Each task's number and complexity likely exceeded their training and ability to perform in such a compressed period of time, especially with hands that were too cold to make an "OK" sign and a dry suit that was likely squeezing them.

Many red flags existed that should have resulted in stopping this dive. It is difficult to understand how so many things could have gone wrong to result in this tragedy. If you take one thing away from this mishap, please let it be that every person (even you) involved in a dive has the ability to ask questions, raise safety concerns, or provide better technical information to those involved. The military dive community rarely suffers a loss due to wartime action or essential military operations. It is the non-essential dives conducted for training or other routine events that result in the most fatalities, and those fatalities are most often a result of the actions of personnel, not equipment. Complex diving operations performed in arduous conditions are routinely completed without incident due to effective planning, training, qualification, and supervision. Remove one of those four essential factors and even an "easy" dive becomes dangerous.



This report is a summary of information extracted from an administrative investigation of the incident and a complete analysis conducted by the Commandant of the USCG, the results of which led to a congressional hearing before the Senate Subcommittee on Oceans, Atmospheres, Fisheries, and Coast Guard. The subject of the hearing was "The Future of the Coast Guard Diving Program."

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And remember — Let's be careful out there.